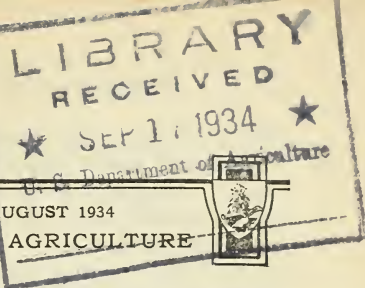


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## STUDIES ON HANDLING SUGARCANE FROZEN EARLY IN MARCH IN ADVANCED STAGES OF DEVELOPMENT

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### INTRODUCTION

Under normal Louisiana weather conditions, sugarcane is usually kept in a state of practical dormancy during December, January, and February by reason of prevailingly low temperatures. Within that period several freezes are usually experienced that are sufficiently severe to kill back any growth which may take place. During the mild winter of 1931-32 sugarcane continued growth until March 9, when a temperature of 25° F. was recorded at the United States Sugar Plant Field Station, located at Houma, La. Similar temperatures occurred throughout most of southern Louisiana, resulting in severe damage to sugarcane except in certain protected localities. The advanced condition of the cane at the time of the freeze is indicated by the data given in table 1, showing the height of jointing of the tallest stalks of three representative varieties in date-of-planting tests at the Houma field station. Similar conditions occur infrequently in Louisiana, the only previous occurrence of record being that mentioned by Stubbs<sup>1</sup> as having occurred in 1890. He does not mention the methods followed in handling the cane which was frozen early in March after having grown throughout the winter, and in the absence of records on the subject the planters in Louisiana were at a loss concerning the most suitable means for handling the crop following the freeze in March 1932. The results of experimental studies on methods of handling the frozen cane recorded herein should prove valuable in the event of occurrence of a similar situation.

Studies showed that the damage was largely dependent on the stage of growth attained by the cane at the time of the freeze. In the case of young cane, where the growing tip was well protected within the foliage envelop, terminal buds were usually found in a viable condi-

<sup>1</sup> STUBBS, W. C. CULTIVATION OF SUGARCANE. IN TWO PARTS. PART FIRST. SUGARCANE; A TREATISE ON ITS HISTORY, BOTANY AND AGRICULTURE. P. 38. Savannah, Ga. 1900.

tion. On the other hand, where considerable growth had taken place before the freeze, terminal buds of most of the jointed stalks were dead. In such cases, however, due to the protection afforded by surrounding foliage, injury to many of the younger shoots was comparatively slight.

TABLE 1.—*Stage of growth attained on Mar. 9, 1932, by plant cane of representative varieties planted at different dates during the summer and fall of 1931*

Date planted (1931)	Height of jointing of tallest stalk of—		
	C.P. 807	Co. 231	P.O.J. 213
	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>
Aug. 1.....	40-44	28-34	24-28
Aug. 15.....	32-36	22-28	14-18
Sept. 1.....	24-30	16-20	7-9
Sept. 15.....	16-20	10-14	2-4
Oct. 1.....	8-10	5-6	1-2

The situation presented conditions differing in two fundamental respects from those usually prevailing in Louisiana; viz, (1) the cane had in most cases attained an abnormally advanced stage of growth at the time it was frozen back, and (2) the period of interrupted growth was much shorter than usual. It was generally felt that where the cane had made comparatively little growth previous to being frozen back, no reason existed for shaving or otherwise cutting it back. There was considerable uncertainty, however, as to the best procedure in cases of advanced growth, especially where the older stalks had formed several joints above the ground. It was feared that the excessive quantity of trash would have an unfavorable effect on suckering and growth. Furthermore, in extreme cases, some of the older stalks with frozen terminal buds showed many apparently live lateral buds above the ground surface, thus rendering possible an undesirable type of growth.

The course followed in cases where cane had jointed above the ground varied considerably on different plantations. Many growers decided not to remove the dead growth. In some cases, plant cane and stubble were shaved by means of the commonly used stubble shavers. In other instances, the frozen cane was cut to a height of from 2 to 4 inches above the ground by means of mowing machines, while in still other cases cane knives, scythe blades, or other hand implements were used. A few growers attempted burning, but the dead growth did not burn satisfactorily immediately following the freeze. By the time the dead leaves had become sufficiently dry, so much new growth had taken place that burning was out of the question.

Following the freeze, temperature and other conditions throughout March and April were very favorable for renewed suckering and rapid growth, with the result that by the 1st of May the cane had reached a more advanced state of growth than the normal for that date. Suitable temperatures and ample and advantageously distributed rainfall throughout the remainder of the growing season favored the

growth of the crop, and at the beginning of the harvesting period it had reached a more advanced state of growth than that attained by the average crop in Louisiana at a corresponding period. Abnormally cool weather during October and in early November retarded vegetative growth but favored ripening-off of the crop and, concurrent with the advanced condition of the crop, resulted in unusually high percentages of sucrose in the cane. Growth was abruptly checked by a freeze which occurred on November 13, though the minimum temperature recorded (27° F.) did not seriously injure the crop. A more severe freeze on December 17 (25° F.) resulted in considerable injury to the cane with succeeding general but comparatively slow deterioration. A more complete description of weather conditions may be found in Circular 298.<sup>2</sup>

Tests were conducted at the United States Sugar Plant Field Station at Houma and on several cooperating plantations to determine the effects of different methods of handling the growth of sugarcane which had reached various stages of development at the time of the freeze. In the case of plant cane, the trash-removal operation was done by hand with cane knives. In the case of stubble it was done by means of mechanical stubble shavers, such as are commonly used on plantations.

#### FIELD STUDIES

Results of field studies conducted during late April and early May in connection with several of the tests are summarized in tables 2 and 3. It will be seen by a study of the data given that both shaving and topping had resulted in an increased number of shoots per acre and a lesser average height of shoots at the time of observation. Observations conducted on cane that had reached considerably advanced stages of development before being frozen back indicated that some aerial shoots had developed from unshaved cane where the stalks had jointed 15 inches or more, but the extent of this undesirable growth appeared to be negligible where stalks had jointed less than 20 inches above the ground. In this connection, observations were conducted on a field of C.P. 807 on Southdown plantation, planted on August 10, 1931, where the tallest stalks had jointed from 32 to 34 inches above the ground surface at the time of the freeze. Based on counts made on May 23, 1932, the number of stalks per acre having developed two or more aerial shoots was estimated to be 4,500. Similar studies on Co. 281 first stubble, where the previous crop was cut October 1, 1931, and where the stalks had jointed from 8 to 10 inches before the freeze, revealed no aerial shoot development.

<sup>2</sup> ARCENEUX, G., STOKES, I. E., BISLAND, R. B., and KRUMBHAAR, C. C. VARIETY TESTS OF SUGARCANES IN LOUISIANA DURING THE CROP YEAR 1931-32. U.S. Dept. Agr. Circ. 298, 32 pp. 1933.



TABLE 2.—Results of topping and shaving plant cane on height and number of shoots per acre<sup>1</sup>

Variety	Date planted (1931)	Average number of shoots per acre from—			Average height of shoots <sup>2</sup> from—		
		Plants shaved to ground surface	Plants topped 5 inches above ground surface	Plants used as check	Plants shaved to ground surface	Plants topped 5 inches above ground surface	Plants used as check
Group <sup>3</sup> .....	Oct. 2	Number 62,253	Number 49,344	Number 48,626	Inches 3.64	Inches 4.74	Inches 6.01
Co. 281.....	Sept. 23	53,160	54,233	46,930	2.775	3.971	4.207
Group <sup>4</sup> .....	Sept. 28	44,141	41,606	41,698	2.50	3.32	3.75
Do.....	Oct. 12	49,888	42,375	36,902	3.55	4.15	5.49

<sup>1</sup> Treatments applied Mar. 16, 1932. Counts and measurements made Apr. 26 to May 2, 1932.<sup>2</sup> Height above ground of highest blade joint.<sup>3</sup> P.O.J. 36-M, P.O.J. 213, P.O.J. 234, Co. 281, Co. 290, and C.P. 807. Individual varietal results were in close agreement with group averages as to observed trends.TABLE 3.—Effect of shaving stubble cane on average height and number of shoots<sup>1</sup>

Variety	Crop	Average number of shoots per acre from—		Average height of shoots from—	
		Plants shaved	Plants used as check	Plants shaved	Plants used as check
Group <sup>2</sup> .....	First stubble.....	Number 33,261	Number 21,153	Inches 3.04	Inches 3.89
Co. 281.....	do.....	19,000	15,242	2.87	4.00
Group <sup>3</sup> .....	Second stubble.....	54,016	31,653	2.72	3.78
Group <sup>4</sup> .....	Third stubble.....	37,700	30,380	2.43	3.39

<sup>1</sup> Counts and measurements made Apr. 27 to 29, 1932. In all cases, individual varietal results were in close agreement with group averages as to observed trends.<sup>2</sup> Averages of results obtained with P.O.J. 36, P.O.J. 36-M, P.O.J. 213, P.O.J. 234, Co. 281, and C.P. 807.<sup>3</sup> Averages of results obtained with varieties given in footnote 2 plus the varieties C.P. 71-B, C.P. 177, and C.P. 766.<sup>4</sup> Averages of results obtained with P.O.J. 36, P.O.J. 36-M, P.O.J. 213, Co. 281, C.P. 807, and C.P. 177.

## YIELD RESULTS

Tables 4 to 7, inclusive, show the observed yields of cane and indicated yields of sugar obtained at harvest in connection with the above-mentioned post-freeze treatment tests. With cane planted at the usual time in the fall (table 4), apparently little, if any, harm resulted from cutting back the dead growth, but there were no indications of any benefit. The results of cutting and topping cane planted in August and September are given in table 5. While the individual tests showed the usual variations associated with limited replications, the average results indicate rather definitely that the effects of shaving and topping were on the whole detrimental. Topping resulted in lower yields of cane per acre in the average of each variety, while shaved plots were lower than corresponding controls in the case of 4 out of 6 varietal averages. In the average of all shaved plots, as well as in the average of all topped plots, the reduction in yield as compared to controls was in excess of 1½ tons per acre. Observed differences in yield of sugar per ton of cane between treated and

check plots were inconsistent and apparently within the range of experimental error.

Results of tests on shaving stubble cane immediately following the freeze (table 6) show that this treatment resulted in reduced yields of cane per acre in the case of 5 varieties out of 6 and in the average of 6 varieties. The greatest reductions in yield were obtained in the case of C.P. 807. Table 7 gives the results of more extensive shaving tests with C.P. 807 and Co. 281. Shaving C.P. 807 on March 16 resulted in a very negligible difference in yield of cane per acre and a difference in yield of sugar per ton of cane probably within the range of experimental error, while shaving on April 16 unquestionably decreased the yield of cane and sugar per acre and apparently decreased the yield of sugar per ton of cane. Plots of Co. 281 shaved on March 16 showed somewhat lower yields of cane than corresponding check plots, although the difference cannot be regarded as highly significant. In this case, almost identical yields of sugar per ton of cane were obtained from shaved and check plots.

TABLE 4.—Results of tests at the United States Sugar Plant Field Station, Houma, La., on shaving and topping of cane following the freeze of Mar. 9, 1932. Cane was planted in October 1931<sup>1</sup>

YIELD OF CANE PER ACRE (TONS)<sup>2</sup>

Variety	Tests on light soil <sup>3</sup>		Tests on heavy soil <sup>3</sup>		Average of—		
	Shaved	Topped	Shaved	Topped	Shaved	Topped	All treated plots
P.O.J. 36-M.....	-1.44	+0.71	-0.93	+0.49	-1.18	+0.60	-0.29
P.O.J. 213.....	+ .29	+1.44	+3.20	+1.94	+1.74	+1.69	+1.71
P.O.J. 234.....	-.50	+ .06	+ .61	-.34	+ .05	-.14	-.04
C.P. 807.....	+ .77	+ .46	+3.83	-.98	+2.30	-.26	+1.02
Co. 281.....	-1.52	+1.36	+ .70	+1.29	-.41	+1.32	+ .46
Co. 290.....	-4.20	-4.65	+ .54	-3.13	-1.83	-3.89	-2.86
Average.....	-1.10	-.10	+1.32	-.12	+ .11	-.11	0

YIELD OF SUGAR PER TON OF CANE (POUNDS)

P.O.J. 36-M.....	-0.4	+0.3	-10.3	-2.0	-5.35	-0.85	-3.10
P.O.J. 213.....	+3.9	+ .5	-11.4	-.2	-3.75	+ .15	-1.80
P.O.J. 234.....	+4.7	+6.6	-10.8	-7.2	-3.05	-.30	-1.67
C.P. 807.....	+8.6	+2.9	+6.4	+5.0	+7.50	+3.95	+5.72
Co. 281.....	-5.6	-.8	-8.7	-2.5	-7.15	-1.65	-4.40
Co. 290.....	+7.4	-.8	-2.5	+1.0	+2.45	+ .10	+1.27
Average.....	+3.1	+1.45	-6.2	-.98	-1.56	+ .23	-.66

YIELD OF SUGAR PER ACRE (POUNDS)

P.O.J. 36-M.....	-258	+130	-369	+48	-313	+89	-112
P.O.J. 213.....	+146	+291	+383	+387	+264	+339	+301
P.O.J. 234.....	+14	+179	-105	-231	-45	-26	-35
C.P. 807.....	+436	+185	+922	-49	+679	+68	+373
Co. 281.....	-470	+275	-66	+207	-268	+241	-13
Co. 290.....	-403	-806	+4	-520	-199	-663	-431
Average.....	-89	+42	+128	-26	+20	+8	+14

<sup>1</sup> Indicated treatment applied between Mar. 10 and Mar. 16, 1932.

<sup>2</sup> Tons of 2,000 pounds are used in tests reported in this circular.

<sup>3</sup> Observed increase (+) or decrease (-) in average yields from treated plots as compared to average of corresponding check plots. Average of 2 replications. Tests on light soil harvested Dec. 21, 1932; tests on heavy soil harvested Dec. 17, 1932.

TABLE 5.—Results of tests at plantations on shaving and topping cane following the freeze of Mar. 9, 1932.<sup>1</sup> Cane was planted in August and September 1931

Variety	YIELD OF CANE PER ACRE (TONS)										
	Tests on the Greenwood plantation, Thibodaux, La. <sup>2</sup>			Tests on the Midway plantation, Foster, La. <sup>2</sup>			Tests at the Houma field station <sup>2</sup>				Average
	Planted Aug. 1, 1931		Planted Aug. 15, 1931	Planted Aug. 1, 1931		Planted Aug. 15, 1931	Planted Aug. 1, 1931		Planted Sept. 1, 1931		
	Shaved	Topped		Shaved	Topped		Shaved	Topped		Shaved	
P.O.J. 36-M	-2.95	-1.82	+3.40	-5.67	-6.35	+2.03	-1.39	+1.13	-3.02	+1.13	-0.68
P.O.J. 213	-2.23	+2.04	-1.30	-6.30	-5.07	-8.17	-7.47	-1.36	-7.24	-2.27	-1.45
P.O.J. 234	-2.23	+2.04	-2.27	-1.13	-5.07	+2.72	+5.43	+1.82	+1.13	-1.81	-8.2
Co. 281	-4.54	+5.08	-7.94	-2.72	-1.81	-5.68	-0.96	-91	-6.80	+5.43	-63
Co. 280							-12.67	-4.52	-5.43	+9.28	-4.52
C.P. 807	+3.86	+2.95	-1.58	+1.14	-.68	+3.41	-6.57	-0.73	+4.29	+10.41	-1.50
Average											-1.83
											-1.60
YIELD OF SUGAR PER TON OF CANE (POUNDS)											
P.O.J. 36-M	-4.8	+7.1	-1.8	-12.2	-4.8	-7.2	-14.0	-6.5	-22.8	-8.0	+0.72
P.O.J. 213	-17.1	-10.4	+2.6	-18.6	+14.6	+25.8	-3.6	-2.0	-13.1	-8.4	+5.86
P.O.J. 234	+5.4	+58.8	+47.7	-12.2	-2.6	-7.2	+7.1	+11.1	-7.1	+16.3	+12.18
Co. 281	-2.6	-7.5	+1.4	-11.9	+6.5	-13.3	+4.8	-2	-8.1	-4.7	-2.62
Co. 280							-4.5	+7.0	-18.3	-10.1	+7.00
C.P. 807	-16.0	-13.7	+23.9	+6.1	-3	+7.3	+6.3	-10.5	+1.4	+9.2	-48
Average											+3.79
											-2.12
YIELD OF SUGAR PER ACRE (POUNDS)											
P.O.J. 36-M	-702	-206	+597	-1,576	-1,526	+263	-637	+63	-1,153	+43	-139
P.O.J. 213	-547	+87	-243	-1,429	-737	-995	-2,330	-586	-1,877	-700	-170
P.O.J. 234	+88	+356	+990	-614	-1,253	+391	+1,275	+726	-513	-62	+123
Co. 281	-1,070	+911	-1,689	-1,181	-734	-1,903	-2,274	-149	-1,890	+1,173	-262
Co. 280							-2,746	-607	-763	+1,547	-607
C.P. 807	+17	-41	+685	+472	-146	+746	-685	-1,523	+909	+2,398	-140
Average											-473
											-202

<sup>1</sup> Indicated treatments applied between Mar. 10 and Mar. 10, 1932.

<sup>2</sup> Observed increase (+) or decrease (-) in average yields from treated plots as compared to average of corresponding check plots. Average of 3 replications. Tests at Thibodaux harvested Nov. 28, 1932; tests at Foster harvested Dec. 8, 1932; tests at Houma harvested Dec. 12, 1932.



TABLE 6.—Results of shaving tests at the United States Sugar Plant Field Station, Houma, La., on first-, second-, and third-stubble cane following the freeze of Mar. 9, 1932 <sup>1</sup>

Variety	First stubble			Second stubble			Third stubble			Average <sup>3</sup>		
	Average yield of cane per acre <sup>2</sup>	Indicated yield of 96° sugar <sup>2</sup>		Average yield of cane per acre <sup>2</sup>	Indicated yield of 96° sugar <sup>2</sup>		Average yield of cane per acre <sup>2</sup>	Indicated yield of 96° sugar <sup>2</sup>		Average yield of cane per acre <sup>2</sup>	Indicated yield of 96° sugar <sup>2</sup>	
		Per ton of cane	Per acre		Per ton of cane	Per acre		Per ton of cane	Per acre		Per ton of cane	Per acre
P.O.J. 36.....	Tons	Lbs.	Lbs.	Tons	Lbs.	Lbs.	Tons	Lbs.	Lbs.	Tons	Lbs.	Lbs.
P.O.J. 36-M.....	-0.45	-8.8	-255	-0.96	+4.0	-64	0.00	+1.4	+22	-0.47	-1.13	-99
P.O.J. 213.....	-.91	-4.8	-264	-1.70	+7.9	-112	+1.76	-4.7	+31	-.28	-53	-115
P.O.J. 234.....	-1.75	-2.4	-380	+2.25	+7.4	+514	-2.03	+13.8	-55	-.51	+6.27	+26
P.O.J. 281.....	-1.11	+2.8	-194	+1.64	+6.4	+800	.....	.....	.....	+1.26	+4.60	+303
C.P. 807.....	+4.45	-4.6	-10	+1.75	+9.7	+501	-2.39	-7.7	-588	-1.06	-87	-32
	-2.27	-10.8	-751	-2.83	-4.7	-601	-3.56	-3.4	-632	-2.89	-6.30	-661
Average.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	-.66	+1.34	-96

<sup>1</sup> Cane shaved between Mar. 10 and Mar. 16, 1932.<sup>2</sup> Observed increase (+) or decrease (-) in average of shaved plots as compared to the average of corresponding check plots. Average of 2 replications. First stubble tests harvested Nov. 7, 1932; second stubble tests harvested Oct. 29, 1932; third stubble tests harvested Oct. 20, 1932.<sup>3</sup> Simple average.

TABLE 7.—Results of delayed shaving tests at the United States Sugar Plant Field Station, Houma, La., on first- and second-stubble cane following the freeze of Mar. 9, 1932

Treatment	Tests with Co. 281 first stubble <sup>1</sup>			Tests with C.P. 807 second stubble <sup>3</sup>		
	Average yield of cane per acre <sup>2</sup>	Indicated yield of 96° sugar at harvest		Average yield of cane per acre <sup>4</sup>	Indicated yield of 96° sugar at harvest	
		Per ton of cane	Per acre		Per ton of cane	Per acre
	Tons	Pounds	Pounds	Tons	Pounds	Pounds
Shaved (Mar. 16).....	21.62	198.5	4,292	28.21	183.2	5,168
Shaved (Apr. 16).....	.....	.....	.....	21.67	180.5	3,911
Check (not shaved).....	23.07	198.7	4,584	23.14	187.1	5,265

<sup>1</sup> Cane harvested on Nov. 2, 1932.<sup>2</sup> For P=0.01, difference=±1.72.<sup>3</sup> Cane harvested on Nov. 12, 1932.<sup>4</sup> For P=0.01, difference=±4.63.

In most instances it was observed that, following the freeze, the dead growth disintegrated rapidly and apparently did not interfere with subsequent growth of cane or with the harvesting operations. In some instances, however, where vigorous varieties, such as C.P. 807, had been planted during early August, the growth was such as to render its removal almost imperative. In such instances many of the lateral buds survived and developed into aerial shoots, where the cane was not cut back to the ground. Except in such extreme cases, however, it may be said, in summarizing the results of all tests, that the operation of cutting back the frozen growth of cane following the freeze was not only on the whole useless but, in many instances, resulted in lowering the yields of cane and sugar per acre.

## SUMMARY

Results of experimental studies on methods of handling sugarcane frozen early in March in Louisiana when in advanced stages of development indicate that where the cane had reached a stage of growth permitting the development of aerial shoots from surviving buds on the stalk, removal of the frozen growth was beneficial. In the case of cane in lesser stages of development, removal of the frozen growth by cutting or shaving was not only generally useless in that it exerted no beneficial effect, but in many instances such treatment resulted in decreasing the yields of cane and sugar per acre.



